Department of Defense
HUMAN SYSTEMS OVERVIEW

Training Challenges and Technology Roadmap

Distribution A: Approved for Public Release

Roadmaps Tuned to Strategic Guidance of January, 2012

- **President**
  - … focus on … Asia Pacific …. deepening partnerships
  - … military is agile, flexible, and ready for the full range of contingencies
- **DepSecDef**
  - … Joint Force of the future that will be smaller and leaner, but will be agile, flexible, ready, and technologically advanced.
  - … led by the highest quality, battle-tested professionals
- **Primary Missions**
  - Counter Terrorism and Irregular Warfare
  - Deter and Defeat Aggression
  - Provide a Stabilizing Presence
  - Conduct Stability and Counterinsurgency Operations
  - Conduct Humanitarian, Disaster Relief, and Other Operations
- **Joint Force**
  - … resist the temptation to sacrifice readiness
  - … limited resources may better tuned to their requirements
  - … encourage innovation in concepts of operation

Summary – Human Systems

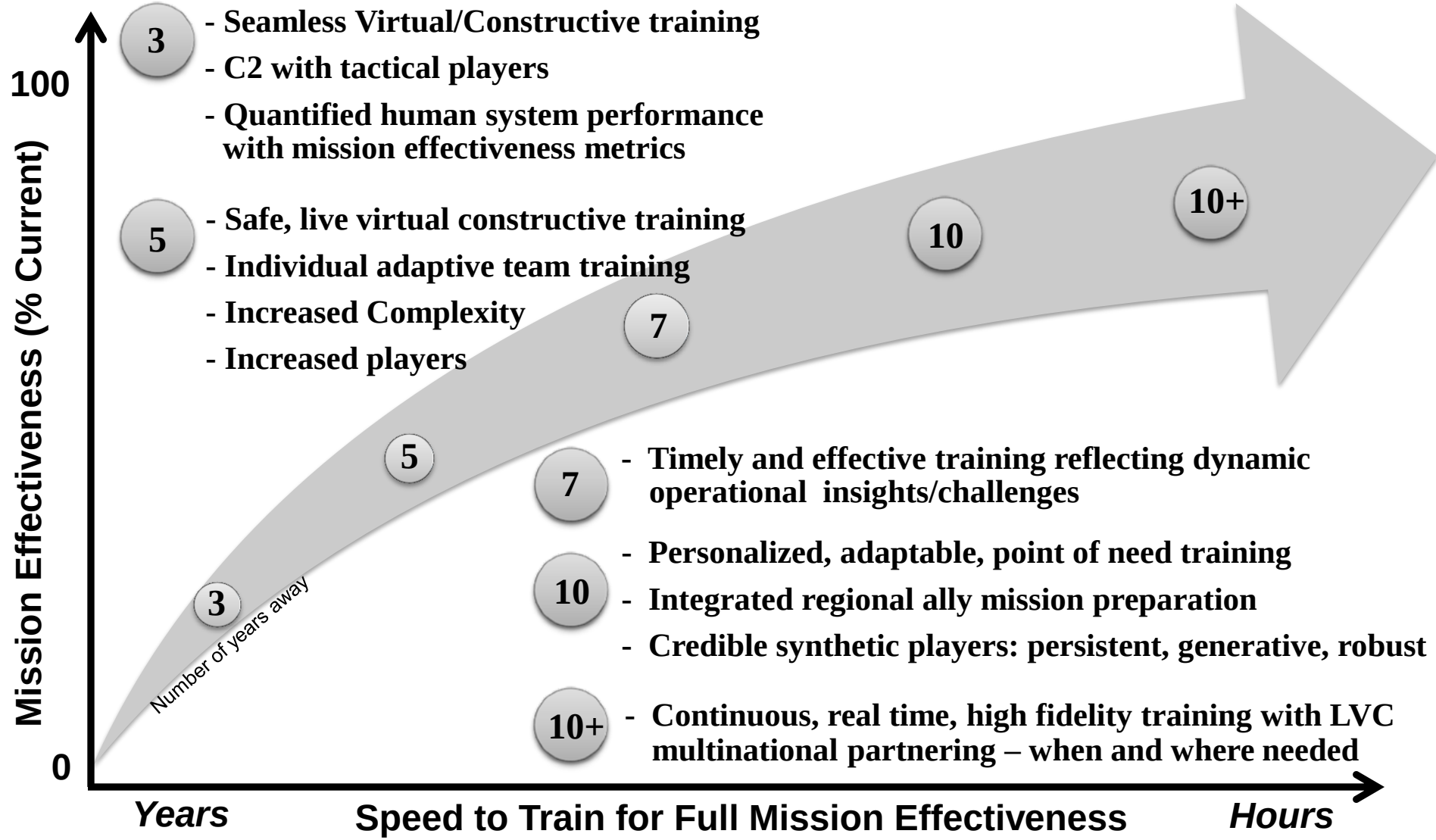
- **Big Ideas**
  - Enable Engineering and Assessment for Joint Mission Effectiveness
    - Baseline Effectiveness Using Realistic Mission Training Scenarios
    - Extend Mission Training Scenarios to Joint Missions
    - Provide Synthetic Environments for Collaboration with Industry, Others
  - Natural interfaces to manage multiple scale multiple role systems
    - Develop common representation schemes for system/data interaction
    - Develop natural language and gestural system interaction
    - Develop operator state monitoring technology

Human Systems Training for Readiness

Problem: Complex Evolving Threats Outpace Readiness Training

- Warriors train for tomorrow's fight using yesterday's technology, methods, and strategies
- Current training scenarios not matched to evolving mission complexity and dynamics
- Warfighters are trained to doctrine -- fight strategically and dynamically to meet new threats
- Training is costly
  - Live systems deplete inventory, consume fuel, require maintenance & wear out
  - Ranges & role players are expensive – lack fast responsiveness to changing scenarios
  - Training ranges not designed for flexible scenarios and throughput is inadequate

Training Technology End States



Human Systems Training Technical Challenges

Challenge 1: First Principles for Training Design

- Validated tools to optimize training outcomes across individuals and teams
- Characterizing and exploiting the "science of learning" and developing performance measures for effectiveness prediction
- Techniques to automatically capture operationally relevant measures of performance

Challenge 2: Realistic, Adaptive and Interactive Scenario Based Training

- Persistent integration of real world events and content into scenarios and syllabi
- Demonstrated and validated for the full range of warfighter capabilities reflecting recent lessons learned
- Training that adapts to warfighters' individual needs in near real-time

Challenge 3: Persistent, Affordable, Integrated Training

- Mission-focused training simulations that enhance individual and collective training
- Seamless, secure integration of training systems across services and coalition partners

Training Challenges

#1 – First Principles for Training Design

Gaps

- Estimated operational effectiveness via training scenarios
- Verification & Validation of advanced training models
- Measures and assessment of long term (life long) performance

#2 – Realistic, Adaptive, and Interactive Scenario Based Training

Gaps

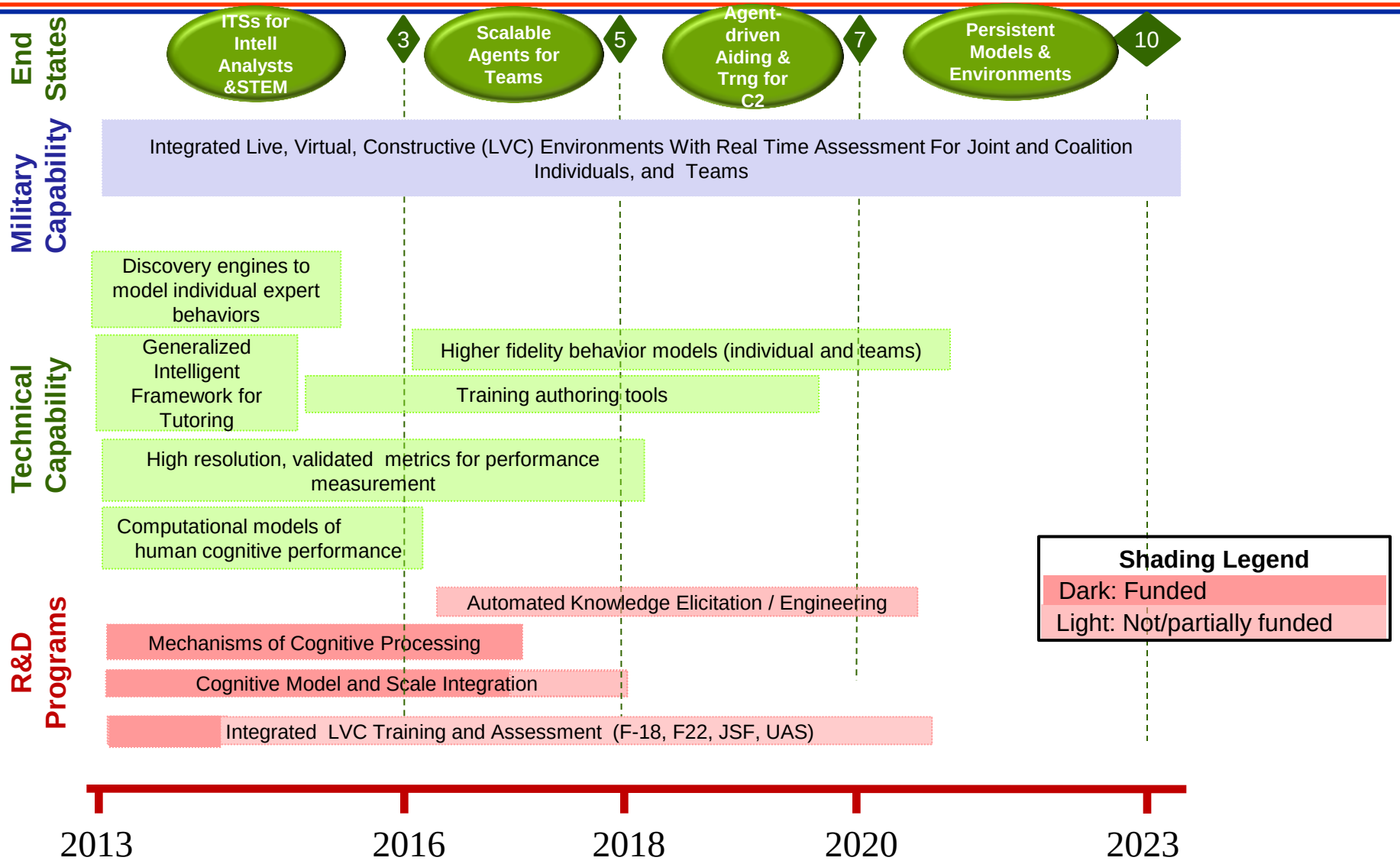
- Automated, adaptive, and individualized tutors
- Automated knowledge elicitation to develop responsive instructional content
- "On the fly" assessment in dynamic environments

#3 – Persistent, Affordable, Integrated Training

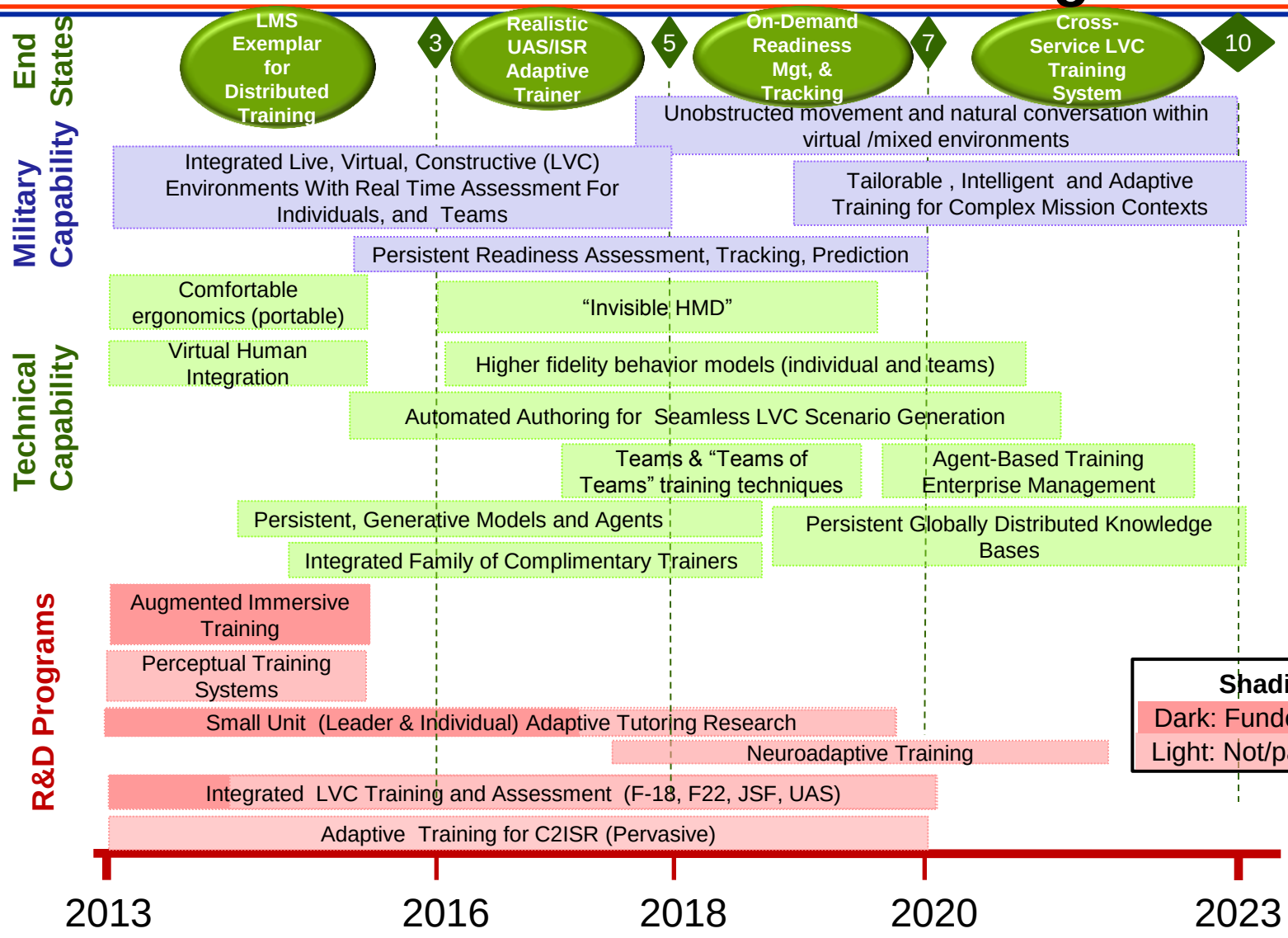
Gaps

- Training systems which adapt to individual needs
- Standardized data protocols for operation in multi-level classified environments
- Scalability across increasingly complex domains

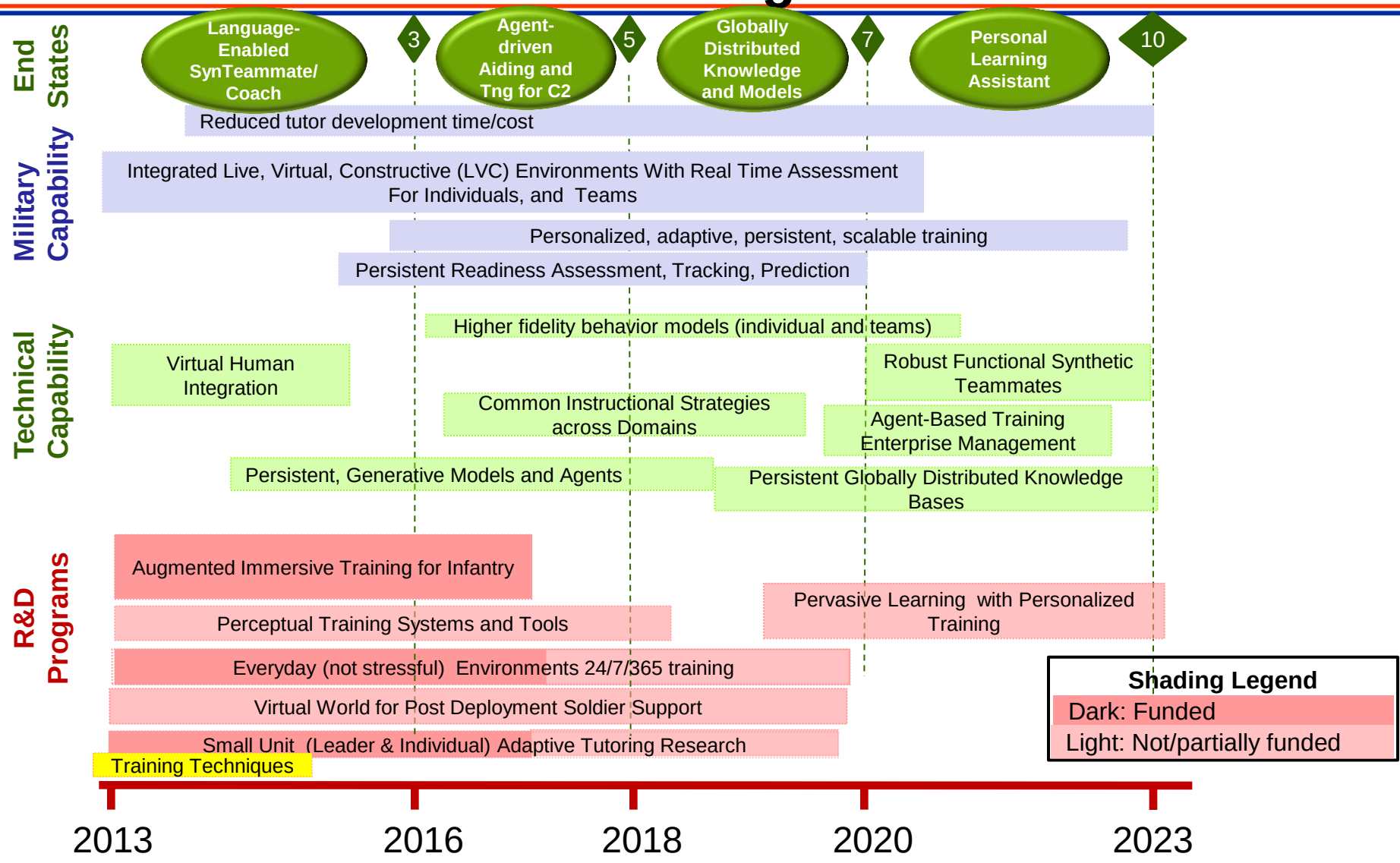
Training Roadmap – First Principles for Training Design



Training Roadmap – Realistic, Adaptive and Interactive Scenario Based Training



Training Roadmap – Persistent, Affordable, Integrated Training



Summary

- **Engineering and Assessment for Joint Mission Effectiveness**
- **Natural interfaces to manage multiple scale multiple role systems**

BACKUP

Interfaces and Training End States

Lessons Learned from the field

Continually Updated Training Regimen

Up to date, synergistic training

Training & Tactics

LVC with Current Tactics
Adaptive Tutoring / Training
Home-based Combat Training
Mission Rehearsal

Training & Tactics

"Instrumented" Operator

"Instrumented" System

Today

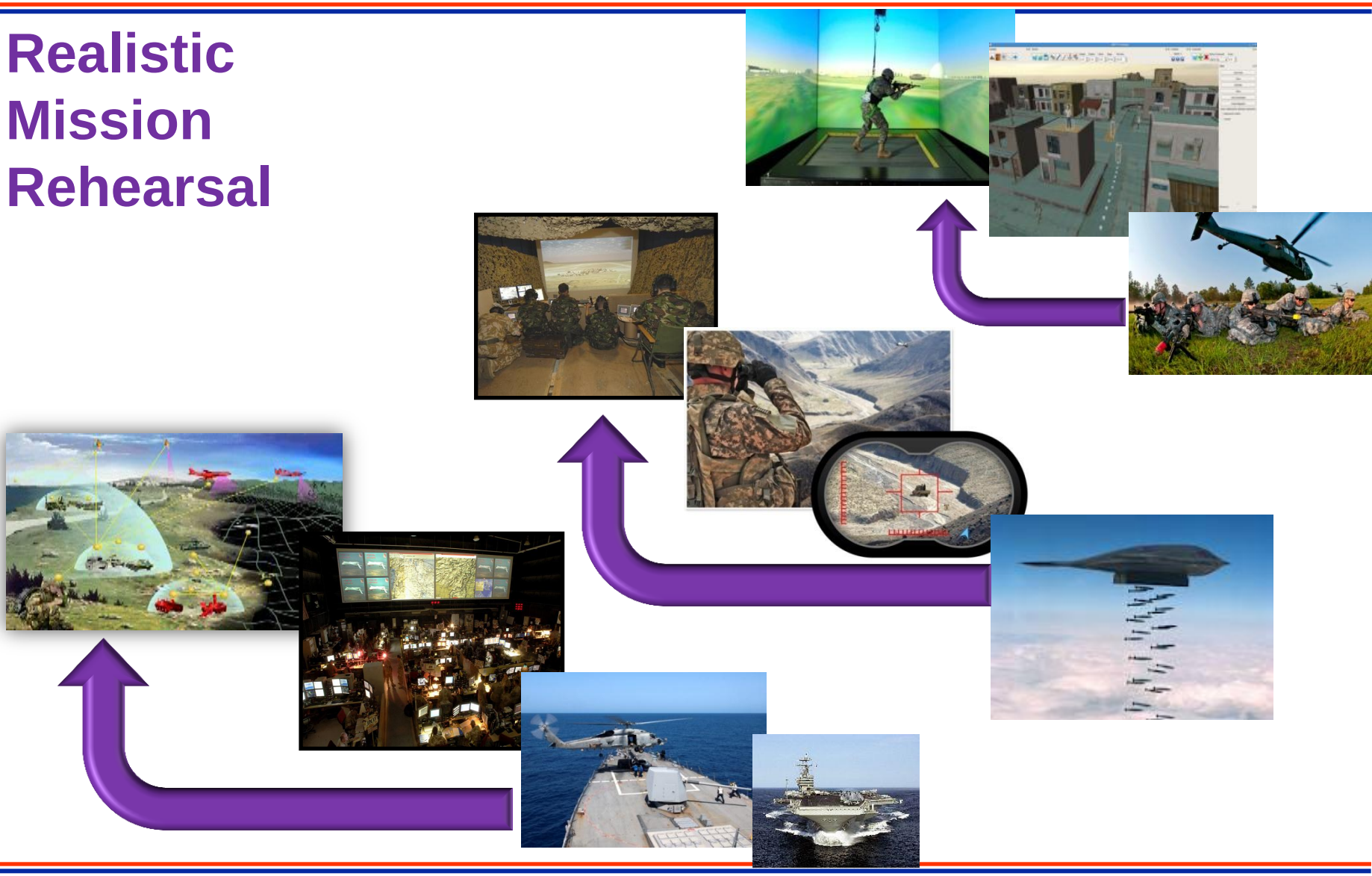
The Future:
Human Systems - Autonomy

Cognitive Processing, Visualization, Neuroscience, System State Adaptation, Continuous Learning

Operator-State Adaptation, Autonomous Intent, Cognitive Modeling

Training Vision

Realistic Mission Rehearsal



Human Systems Training Measures of Success

Challenge 1: First Principles for Training Design

- At least one sigma performance improvement of trainees across domains / applications
- Automated measurement capability that produces meaningful feedback for individual and/or collective performance in live and virtual training exercises

Challenge 2: Realistic, Adaptive and Interactive Scenario Based Training

- Automatic players in training scenarios indistinguishable from live players ('Turing Test')
- Improved performance resulting from training that automatically adapts in near real time
- 25% reduction in time and cost to develop training scenarios

Challenge 3: Persistent, Affordable, Integrated Training

- Capability to deliver training to any internet-capable device
- Affordable, turnkey capability to link simulations across services for joint training exercises

Human Systems Measures of Success

Challenge 1: Human-Machine Teaming

- Number of UxVs controlled by single operator
- Number of warfighters and UxVs supported in roles
- Per cent of operator requests anticipated
- Latency for machine-generated alternative courses of action

Challenge 2: Intelligent, Adaptive Aiding

- Speed and accuracy of decisions X scope
- Transaction rate of relevant information
- Increased situation awareness

Challenge 3: Intuitive Interaction

- Accuracy of operator state assessment
- Effectiveness of natural language dialogue
- Ease of interaction, time to achieve full competency